

## THE PAPAW TREE.

BY

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The CARICACEAE, natives of tropical America and Africa, are a small family of plants, including 4 genera and 45 species.

The family has been named after one of its genera, the genus CARICA. This generic name is derived from the Greek word *Karikos* which means *of* or *from Caria*, a province of Asia Minor, erroneously supposed at one time to have been the habitat of the papayads. The genus *Carica* numbers 30 species, inhabiting warm America.

The papayads are small trees, generally without branches. They have large palmately-lobed leaves, and on being wounded in certain parts they exude an acrid milky juice. Their flowers are borne in racemes proceeding from the bases of the leaf-stalks, the male and female flowers being usually on different trees. The male flowers have a funnel-shaped corolla, into the throat of which the ten stamens are inserted in two rows of five, one above the other; and the female flowers have a corolla of five distinct petals. The fruit is fleshy, and does not split open when ripe.

The most remarkable species is the PAPAW TREE, known to botanists as: *Carica Papaya*, Linn. Sp. Pl. 1036; *C. hermaphrodita*, Blanco, Fl. Filip., ed. i, 205; *Papaya Carica*, Gaertn. Fruct. ii, t. 122; *P. communis*, Noronha, in Verh. Batav. gen. v (1790), ed. i, Art. iv, 23; *P. cucumerina*, Noronha, loc. cit.; *P. sativa*, Tuss. Fl. Antill., iii, 45; *P. vulgaris*, DC. Poir. Encycl., v, 3.

### OCCURRENCE.

**Carica Papaya** Linn. is considered a native of the West Indies, the shores of the Gulf of Mexico, and perhaps of Brazil. Its specific name 'papaya' is evidently American, whether derived from the Carib 'ababai' or not. The tree has now become acclimated in the hot regions of three continents; and the zone of most abundant growth seems to lie on either side of the Equator where the mean annual temperature is 77°F., provided soil and rainfall are favourable. It is grown by cultivation north and south of that zone. It is to be found throughout India, from Delhi to Ceylon; but it cannot be cultivated on the hills, except in the south where it is productive up to 4,000 ft.

It is quite common for numerous papaw plants to spring up from seeds scattered by birds over a portion of land which, according to tropical custom, has been cleared by burning away the trees and undergrowth. There are, however, no forests of papaws because the plants need sun and room. They are seldom seen among dense growths, nor do they propagate in clusters.

The papaw seems to be at its best in the rich humus of a hillside, and rarely takes to a swampy or sandy soil. It grows at the edge of the sea with the waves washing its roots; it prospers on

the high mountain plateaus of all the windward and leeward islands; it flourishes—but does not attain to any great height—on the bare coral rocks of Yucatan; it thrives in the sandy soil of Venezuelan ravines, where rain averages one metre per annum and the climate is very equable; it grows prolifically without much cultivation or care in Peruvian valleys; it shoots up to a height of over one hundred feet in the trans-Andean regions; it appears spontaneously in waste places on the islands of Guam, where it receives but scant attention from the natives. However, those places seem best suited to the papaw where it does not rain but always pours, where daily rains abound throughout the year—pouring, soaking rains with a fierce bright sun shining all through the downpour.

#### CHARACTERISTICS.

Papaw trees present a striking appearance with their straight slim shiny trunks, and their bright green umbrella tops; but whether they are a thing of beauty is a matter of personal taste. 'This well known tree', says Woodrow, 'has been subjected to ill-merited abuse, described as ugly and everything that is disagreeable, yet it may be questioned if there is a more handsome or generally useful tree in Indian gardens.'

The Papaw tree suggests a palm in its habit of growth. It has a single, supple, slim, straight stem, terminating in a crown of large leaves, and branching only when its growth is interfered with. Cultivated plants attain a height of from 10 to 30 ft.; wild varieties push up to 60 or even to 100 ft. Near the base of mature trees the diameter ranges from 6 in. to 1 ft., the stem tapering gradually to about 4 or 5 in. at the summit. In a young plant the stem consists of a cellular pith filled with water; in a matured tree that portion of the trunk immediately under the bark is fibrous for a few inches, followed by a soft inner layer one inch or more thick terminating in the central portion which is hollow. At intervals through the hollow centre are to be seen membranous tissues dividing the cavity into sections, and in the rainy season, for a considerable height up the trunk, this central cavity is filled with water. The wood is soft, white and spongy; it cuts easier than a potato, so that the trunk can be chopped through by a single stroke of a cutlass; it is full of water, decays rapidly, and does not serve any useful purpose. The trunk is covered with a grey (green at the top) smooth, tough bark laid on in folds, which at intervals form ridges.

A large turnip-shaped tap root reaches deep down into the earth to seek nourishment and to give stability to the tree. This root is similar in structure to the trunk, except for a white bark, and possesses an odour of cabbage and a peculiar taste suggesting radishes.

The leaf-stalks diverge almost horizontally from the trunk; they are large and hollow, cylindrical toward the leaf and flattened at the point where they join with the stem. The leaves are frequently as much as two feet in diameter, deeply cut into broad lobes terminating in sharp points and having their margins irregularly waved or gashed; they are dark green on the upper and

light green on the under side; they are shortlived and, as the tree shoots upwards, they drop off, leaving scarry marks on the bark of the tree trunk.

Pitcher formation was observed by Miss Mozelle Isaacs in the leaves of trees growing in the grounds of the Dadar Parsi Colony and of St. Xavier's College, both in Bombay. Pitchers may be best described as modified leaves; and as they only show during the monsoon, it has been surmised that they are due to the vigorous growth of plant life during that period and to the lack of the necessary space for them to develop into ordinary leaves. For in the process of pitcher formation, always found in female plants which usually have larger leaves than the male plants, new veins find themselves impeded from developing normally in the plane of the old leaf as all the available space is already occupied by many strong veins issuing from the same point; these new veins are consequently pushed upwards, and they develop into stalked simple leaves with a basal pocket.

Circumstances of climate, soil and cultivation may, however, so modify the characteristic features of the plant that discrepant descriptions and statements are on record. Among the notable varieties are the green and the violet papaw. This latter variety, which exhibits a purple stem and purple leaf-stalks, has had considerable attention paid to it and is more highly esteemed for cultivation. While young the trees are kept in the shade and pruned to prevent their growing tall; portions of the flowers are picked off to favour fruiting; and the smaller fruits are removed when green, so that the remainder may grow larger and stronger—indeed a fruit weighing 20 pounds is no rarity. The violet papaw is such a pliant plant that horticulturists boast of having produced a dwarf variety. But the green papaw is less adaptable; though it grows to a greater height, its fruit is smaller and possesses a less pleasant flavour.

The male tree produces long hanging clusters of narrow trumpet-shaped flowers having 10 anthers inserted on the throat of the corolla. The female tree bears single flowers with a white, yellow, or purple corolla of 5 sessile petals, and one pistil bearing a 5-rayed stigma. The female flowers grow in considerable numbers at the apex of the stem, which pushes rapidly upwards and puts out new leaf-stalks. Occasionally, bisexual flowers are produced by either male or female trees.

There is no definite flowering season, and the tree bears fruit all the year round. The fruit develops so rapidly that buds of flowers and ripe fruits are often found on a tree at the same time.

The fruit grows from the axils of the lower leaves, the normal fruit from the female flowers being sessile while that from the hermaphrodite flowers is borne on long pedicels. It varies considerably in form as well as in size, resembling an orange, or a gourd, or a cocoa pod, or a musk melon, or even a water melon. It is of a green or purplish colour turning yellow when ripe:

'The slim papaya ripens its yellow fruit for thee'—(Bryant).

Its skin is smooth and thin. The flesh of the green fruit is white, tough and watery; but as the fruit ripens its flesh becomes

juicy and assumes a pinkish or orange hue, or turns to musk-melon yellow. The fruit has a central cavity which contains the seeds arranged in five lines along the whole length of it, and attached to, and held together by, a delicate membrane which constitutes the inner skin of the fruit. The fruit does not last long after ripeness sets in.

Miss Mozelle Isaacs has noted the presence of large white parenchymatous masses in the fruit of the papaw tree. She has also recorded the occasional appearance of long leafy structures: 'in some cases the funiculus is elongated, the integuments of the ovule absorbed in the elongation of the stalk, and the cotyledons and plumule of the seedling inside exposed giving the appearance of vivipary inside the fruit.'

Different names are sometimes employed to distinguish various forms of the fruit, as 'Ceylon', 'Madagascar', 'West Indies', etc.; these names are, however, misleading, for nowhere in the Eastern Tropics is the tree indigenous, and everywhere, as already stated, there occurs a good deal of variety as regards size and shape.

The seeds are of the size of small peas; about 230 when fresh go to an ounce, or 500 when partly dried. When fresh, they are dark brown changing to black on drying. Before desiccation their outer membranous coating is transparent and slimy; the inner coating is hard, horny and wrinkled; and between the two coatings there is a mucilaginous substance containing myrosin. The inner shell contains the leaf-like cotyledons, veined at the base with an albuminous homotropal embryo with a roundish radicle easily distinguished when slightly magnified. The seeds when dried resemble pepper-corns; they are aromatic, pungent, piquant—but not so sharp as mustard—and their taste slightly suggests water cress.

All the parts of the plant abound in milky juice or latex, which is found most abundantly just under the skin of the fruit before ripening.

#### HERMAPHRODITISM.

It is a common belief in the Gold Coast Colony that a male papaw can be made to bear fruits. This is done sometimes by cutting off the top of the male tree, which is then believed to produce fruit-bearing stalks. Another method is to make one or two holes right through the stem below the flowers, a stone or piece of wood being occasionally inserted to keep the hole open.

As a matter of fact the papaw plant is extremely variable in regard to its sexual characteristics. There are two extreme types—one strictly dioecious, the other monoecious—and many intermediate forms. In the strictly dioecious type, the fruit-bearing plant has pistillate flowers only, while the male plant produces almost exclusively staminate flowers in bunches towards the end of long peduncles: each flower has a rudimentary ovary and a style without stigma, being thus incapable of bearing fruit.

It sometimes happens that male trees produce hermaphrodite and pistillate flowers abruptly and unexpectedly. This monoecious type of plant bears fruit in every case; but the trees look from a distance as if they were female plants of the dioecious type. They generally produce two kinds of flowers, the one staminate and the

other perfect. The perfect flower is quite different in shape from the pistillate flower of the dioecious type. Its ovary is much more elongated, being almost cylindrical. The stamens are usually placed on the inner walls of the petals midway down, with the anthers surrounding the lobes of the stigma. The fruit of this type differs from that of the dioecious type in the same way as the ovary, and is often called a 'long papaw'.

Another monoecious form is the plant in the process of changing its sex. It is not at all uncommon for a male plant, after producing staminate flowers for some time, to bear hermaphrodite flowers which in their turn are succeeded by pistillate fruit-bearing flowers. Miss Mozelle Isaacs has, moreover, witnessed the process of change exhibited by a female plant at Santa Cruz, near Bombay. She observed a fruit-bearing tree growing near a drain, changing its sex subsequently on the closing of the drain: the flowers became gradually smaller, lost their ovary, and began to appear in bunches on longer and longer branched inflorescences instead of singly in the axils of the leaves.

It has been repeatedly stated that the removal of the terminal bud causes male papaws to change their sex, and that trees treated at definitely recurring periods are the ones that exhibit this phenomenon. It is suggested that the plant has definite short cycles of growth and that it may be necessary to remove the top at some definite phase of this cycle in order to foster the development of fertile flowers.

To test the correctness of this statement L. B. Kulkarni selected a dozen male plants in the Ganeshkind Botanical Gardens, near Poona, and 'had their growing tips nipped off at the time of flowering. In a fortnight, there appeared a cluster of flowers round the cut portion; on examination eleven trees showed all male flowers, and one plant was found to have produced one hermaphrodite flower among clusters of male flowers. The male flowers on all plants were normal. The one hermaphrodite flower that was produced had five stamens attached to the base of the petals and placed round the syncarpous ovary. The fruit formed was a little oblong. This fruit dropped before ripening. The rest of the trees continued to produce male flowers on long peduncles as usual. The only effect of the pruning of the top was that the trees produced three or four branches.'

This finding supported that of the Hawaii Agricultural Experiment Station: 'It has been reported that staminate trees have been caused to produce pistillate flowers and fruit by beheading them. None of these means have proved to be successful from a practical standpoint.' It may, therefore, safely be concluded that the change of sex displayed by the male papaw does not appear to be in any way connected with the removal or retention of the terminal bud.

It would be puerile to attempt to describe all the intermediate forms which have been observed, for their name is legion and the difference among them is often trivial. However, mention ought to be made of two forms which, strangely enough, have been reported from such widely separated places as Ganeshkind and Hawaii. In the words of L. B. Kulkarni: '(a) One plant

produced four types of flowers, namely: (1) staminate flowers, (2) and (3) two forms of perfect flowers, and (4) one form of pistillate flowers. The staminate flowers were exactly like those of the second or monoecious type above described. Of the two perfect flowers, one form corresponded precisely with that of the monoecious type, while the other had an ovary in shape like that of the pistillate flowers of the dioecious type. There were usually ten stamens attached to the base of the petals round the ovary in the first form—and only five stamens similarly attached in the second form. The pistillate flowers were exactly like those of the dioecious type. '(b) Two plants bore only staminate flowers, but these flowers were carried close to the stem in the axil of the leaf. This is peculiar, as the trees usually producing staminate flowers have their flowers on long peduncles.'

There is, nevertheless, no doubt that the wild papaw in its natural habitat is unisexual. Sex perversion is one of the effects of migration and cultivation.

#### CULTIVATION.

Rusby has stated that this tree 'can be propagated and grown with great readiness, that its vitality is so great that it is with difficulty destroyed until its natural course has been run.' On the other hand six years' observation has convinced Kilmer that the papaw is exceedingly difficult of cultivation, and that the cultivated trees are most easily destroyed by adverse conditions.

The wild plants do not seem to be attacked by disease except after injury, but the cultivated plants are very susceptible to every sort of malady. Insects attack the tender leaves of the young plants and they wither. Fungi and bacteria find in the papaw suitable conditions for growing and multiplying, and they do grow and multiply at the expense of their host's vitality. After fruiting, and especially if the fruits are bled, the tree will suffer from general debility and become the prey of every adverse circumstance. And the trouble, whatever its nature, may be said always to arise from the inherent weakness of the cultivated plant in its altered environment.

It is, nevertheless, reported that in Ceylon, in Brazil, in Algeria and in the islands of La Reunion and the West Indies, successful and extensive cultivations have been carried out.

It is mentioned in the *Hawaii Agricultural Experiment Station Report* for 1911 that 'there is no means available for the propagation of the papaya by asexual parts, as cuttings, buds, scions, etc., hence seed varieties must be established by methods probably similar to those used in breeding varieties of vegetables and flowers which are not propagated by budding and grafting.' But Burns wrote in 1918: 'This excellent fruit is easily grown. It is propagated by seeds, but may also be propagated by cuttings.' And propagation by grafting has been tried with some success at Lucknow, at Ganeshkind, and also in the United States of America.

Propagation by cuttings or by grafting may perhaps not have yielded results which would commend it to the cultivator as a means to increase his harvest. Nevertheless this propagation is

not without its experimental value; for, if persistently carried on, it may contribute towards the solution of a problem which has hitherto baffled scientists and cultivators alike. One never knows what a seedling is going to develop into, and the question of the inheritance of characters in the papaw is one which needs answering very badly; for there happen to be such differences between papaw and papaw that no two trees resemble each other—which is a source of constant anxiety to the cultivator as will be presently shown.

To begin with, the seeds vary considerably in number: in some fruits there are five; in others, over five hundred. But this does not mean five or five hundred potential trees. Thus, for example, when in the West Indies a native wishes to grow a single tree he buries two or three such fruits in the ground; for he knows by experience that at most two or three plants will result. Nothing could show more clearly that very few seeds are fertile, so that a discriminate selection becomes imperative. Experiments were, accordingly, carried out and it was found that seeds taken from the central portion of the largest and finest fruits were the most likely to be fertile. Seeds selected with extreme care from strong and healthy trees, the fruit of which would weigh fifteen pounds, were then sown: only a portion of the plants took after the parent stock, the other portion reverted to the wild prototype and yielded fruits the size of a hen's egg. In another series of plantings conducted with thorough preparation of the ground and selection of seeds, together with care for the young plants, only a small proportion came to maturity, and of these only a few bore fruit: none of the plants or their fruits was as large as those of the parent stock.

But still more perplexing are the vagaries of sex relation, which make the proper adjustment of the sexes difficult and exasperating. It is generally agreed that for fertilization one male to ten female plants is the proper ratio; but Kilmer speaks of numerous instances where acres of land were planted with thousands of papaw plants in which the males were in the majority of over fifteen to one. And as it is not until the flowers appear that the two kinds of tree, male and female, are distinguishable, one can imagine the cultivator's dismay when he finds at the end of all his toil and waiting—which may be as much as twenty months—that he has a plantation of unprofitable male plants.

It is best to sow the seeds in well-drained porous soil covering them about half an inch deep. In from two to six weeks the seedlings appear, germination being hastened by heat. In about a month after germination the seedlings are large enough to be transplanted to pots in which they remain for another month before being placed in the orchard where holes four feet deep and four feet wide were dug previously. The distances between trees should be about ten feet in each direction. Seeds may also be sown at stake, allowing five or six to each hole, leaving afterwards one good seedling to each hole.

The papaw tree likes deep humous or loamy soil, and flat or gently sloping well-manured land. The following fertilizer has been

successfully tried at the Hawaii Experimental Station on young plants: superphosphate, 800; sulphate of potash, 315; nitrate of soda, 250; sulphate of ammonia, 190; and black sand (volcanic ash), 445 parts. This has been applied at the rate of one pound per tree at planting time. In the Bombay Presidency, house, farm, or stable refuse, twenty cartloads per acre, has been used with success. It has also been found that two ploughings and two harrowings just before sowing the seed improve the growth.

Once established, the plant is capable of enduring a wide range of moisture variations in the soil, but it is very sensitive to water-logging. Until the blossoming stage is reached the two kinds of tree are indistinguishable, and hence twice the desired number of seedlings must be planted, and all the males, except four per acre, cut out when they are recognisable. In some localities the plant begins to grow fruit in seven months; in others, eighteen to twenty months from the seed. The fruiting is abundant and continuous. In the course of one season a wild tree has been known to yield from two to three hundred fruits varying in size from a golf ball to a cricket ball. The cultivated plants may be made to yield from twelve to sixty fruits, weighing from five to twenty pounds each.

The fruits of the papaw are borne round the stem in such a way that they interfere seriously with one another's growth. It is, therefore, advantageous to remove a certain number of them to allow the rest to develop better. The difficulty is to hit on exactly the right amount of thinning to get the greatest weight compatible with the greatest number of fruits. This can only be obtained by practice and in the meantime it is advisable to remove only such fruits as are obviously going to be badly squeezed.

It is also a good thing to cut off the top of the young tree, thus forcing it to branch. Each branch bears fruits, and the bearing capacity of the tree is multiplied. It has also been observed that the branched plants were less frequently damaged by winds, and that the fruit was easy to watch and to harvest. The system of branching is very beneficial in places where the nights are cold, since the plant is protected from frost, and the fruit is produced near the ground.

The fruits on the tree must be protected from the direct rays of the sun or they scorch and split. The dead leaves of the tree should be removed as they dry up. The fruit is to be cut from the tree when full sized, but green, and is laid on soft straw to ripen. The even ripening of the papaw is a matter of considerable practical difficulty.

As a rule the tree is played out after five years' continuous cropping. Kilmer reports that a rare specimen was observed which was eighteen years old, and was bearing one to two fruits each year.

#### DOMESTIC USES.

In Africa, America, and the West Indies the bark of the stem is used in the manufacture of ropes.



The hollow leaf-stalks are often used as trumpets by the natives of Guam, some of whom excel in sounding military bugle calls upon them.

The property of the papaw to render meat tender is commonly made use of by cooks, who wrap the leaves round fresh meat, or place a piece of the green fruit in the water in which the meat is being boiled, or drop a little of the fresh juice in the vessel in which the meat is being cooked. In its tropical home the papaw is put into the pot with meat, and enters into cereals, soups, stews and other dishes. Most of the half-breeds in South America and the adjacent islands are particularly given to meat diet; many of them eat it raw, sometimes in a state of partial decay; and here the papaw is brought into use, being eaten with the flesh or rubbed over it before it is eaten.

In the Gold Coast Colony the leaves are added to the water when washing clothes to remove stains. In the Philippine Islands water in which the leaves have been boiled is used to wash off blood stains. In the West Indies the green leaves or slices of the green fruit are rubbed over soiled and spotted clothes, and its power of dissolving stains has earned for the papaw the name of 'melon bleach'. Elsewhere water in which a portion of the fruit has been steeped is used in washing dyed (especially black) clothes without in any way discolouring them.

Again, women in Brazil and the West Indies use the juice of the unripe fruit as a cosmetic; they apply it for freckles and for making the skin smooth and delicate. Says Kilmer: 'The strange and beautiful races of the Antilles astonish the eyes of the traveller who sees them for the first time. It has been said that they have taken their black, brown, olive and yellow skin tints from the satiny and bright-hued rinds of the fruit which surround them. If they are to be believed, the mystery of their clear, clean complexions, and exquisite pulp-like flesh arises from the use of the papaw fruit as a cosmetic. A slice of the ripe fruit is rubbed over the skin and is said to dissolve spare flesh and remove every blemish. It is a toilet requisite in use by the young and the old, producing according to the words of a French writer "the most beautiful specimens of the human race".'

When the natives of New Caledonia run short of tobacco they smoke the leaf of the papaw as a substitute. Writing from Nukahiva in 1879, M. Jouan, *capitaine de vaisseau*, tells of the trouble he experienced to keep donkeys away from his papaw trees, such was the attraction of the leaves for those animals! On the other hand, the French sailor says that the smell of the seeds was too much for the cats which turned up their noses and beat a hasty retreat.

That asses, however, are not the only members of the equine family that have a craving for the papaw, was observed by a most reliable witness, Brother Joseph Pascual, now residing in St. Xavier's College, Bombay, and from 1922 to 1923 in charge of Gayaba, a plantation situated ten miles from Madang in pre-war German New Guinea. According to the witness, Mauritz, a small long-tailed chestnut horse, imported into New Guinea from one

of the neighbouring islands, was always inclined to leave the beaten track and to make a bee line for the nearest papaw tree—papaws grow wild in those parts—and Mauritz's rider could neither doze nor daydream, else he would be brought back to the stern reality under a papaw tree with Mauritz greedily devouring the leaves. But it was not only the leaves that Mauritz ate; he also sampled the fruits which he took whole—skin, flesh and seeds. And if the fruit happened to be somewhat over-ripe it was a sight to see Mauritz gobbling up the dainty with his heart in his mouth, and with the golden coloured juice and squash dripping from the corners of his lower lip.

It would also seem that in South America the younger generation makes use of the seeds to indulge their sporting propensities. As the seeds are encased in a slimy coating advantage is taken of this by playful youngsters who spread them out on a board, and by this means form a 'slide', the counterpart of the frozen gutter so agreeable to northern urchins!

In Upper Tongking, among the Tho and Man hill tribes, the fruits are fed to pigs. Throughout the West Indian islands the fruits and the leaves are fed to old hogs or poultry in the belief that their flesh will without fail become tender.

#### FOOD.

The papaw is not everywhere held in like esteem. The natives of Guam and the Marquesas do not seem to set any store by it, they only eat it when there happens to be a scarcity of other kinds of fruit. This is all the more strange because the inhabitants of the Loyalty Islands and of the other coral islands in the Pacific relish the papaw as a welcome addition to their otherwise scanty fare.

Elsewhere the papaw is considered a wholesome and nutritious food, and consumed in large quantities at all stages of its development. In every West Indian and South American village one will find a place where the native products are bought and sold, and where the wayfarer is sure to come upon an abundant supply of papaws.

As an article of food the papaw is prepared in a score of ways and made into a variety of edible dishes and delicacies.

The green fruit is cooked in curries, and is made into plain and spiced pickles which are highly esteemed. It is also boiled or stewed, and served as a vegetable. In this form it makes a splendid addition to poultry mash; and, if mixed with lime juice and sugar, is an excellent substitute for apple sauce. Europeans in Indo-China prepare it as they would salsify or artichoke.

In Malaya the green fruit, peeled, boiled, cut into small pieces, and dressed with oil, vinegar, salt and pepper is served as a vegetable. It is said to be very palatable and very similar to squash in taste.

The half-ripe fruit lightly fried in butter is a good addition to meat *à la jardinière*, and also a good ingredient in chicken or lobster salad.

The following is a useful recipe for the preparation of papaw

jam: 'Choose fruit three-quarters ripe; remove all skin and seeds, chop up the fruit into small pieces; weigh; add equal weight of sugar, also some green ginger (cut into small pieces), 2 oz. of the latter being sufficient for 6 lb. of fruit; cover up the fruit and sugar, and let the latter dissolve during the night; boil up the next morning until done.'

When not quite ripe the fruit makes a good salad if cut into slices, dressed with oil, vinegar, salt and pepper, and prepared one hour before it is served. In combination with lettuce and sliced cucumber, papaws make a wholesome and nourishing salad.

The fruit, just before ripening, is peeled and sliced, macerated in cold water, with frequent changes of water for some hours; the macerated fruit is then dropped into boiling water, boiled sharply, and served as a vegetable.

The ripe fruit is generally esteemed as a table fruit, and is then eaten uncooked. It has been described as sweet, refreshing, and agreeable; but, every one will admit that it may be sickly, sweet, and insipid. The sweetness of its resinous, pulpy juice often clings to the tongue and remains prevalent for hours. In fact the stranger has first to develop a taste before he can enjoy the flavour of the fruit, and acquire a liking for it. Some people prefer to eat the papaw with salt, with salt and pepper, with a little sugar, with fresh lemon or lime juice, with sherry and cream.

In the Gold Coast Colony the ripe fruit is sometimes cooked together with corn and palm oil. In the West Indies and South America it is combined with some acid fruit and made into tarts; and at the sugar houses slices of the papaw are often seen seething in hot syrup, and pies, shortcakes, sherbets, and pickles from the fruit are greatly relished.

Excellent preserves are made of the ripe fruit, which, for this purpose, is boiled down in sugar and candied. In Indo-China the preserves are flavoured with kirsh or marasquino.

The ripe papaw is also made into jam, marmalade, jelly; it is candied, iced, crystallized and made to rival the best products of the confectioner's shop. 'Le fruit du papayer se transforme, par la confiserie, en un fruit confit d'un goût très fin et délicat rappelant celui du marron glacé associé à celui de la noisette.'

The seeds are eaten as a delicacy. They have an agreeable taste somewhat like water cress; and a piquancy suggestive of mustard. Macerated in vinegar they are served as a condiment. The natives of the tropics quite often chew them to quench their thirst.

In Malaya the small fragrant flowers of the male plant are used in the manufacture of a syrup.

Finally, when a tree has become unproductive and is cut down, the soft, pithy heart is carefully removed and grated and served in just about the same manner as a cocoanut.

#### POPULAR BELIEFS.

The papaw is credited to be possessed of latent and strange powers, some of them so strange that they are here set down under the heading of popular beliefs.

In Barbados the flesh of animals is reported to be hung in the papaw tree overnight in order to soften it. The same idea prevails all over India and this practice is no doubt resorted to by domestic servants and meat and fowl are often hung in the branches of a papaw tree to make them soft and tender.

The statement has likewise passed current that the emanations from the papaw tree will dissolve and digest albumin. Another statement has it that if male animals browse under the papaw tree, they thereby become emasculated.

In Africa the odour emitted by the flowers is believed to be a cause of disease.

A popular belief prevails amongst all classes of women in Southern and Western India that if a pregnant woman partake of even a moderate quantity of the fruit or of the seed, abortion will be the probable result.

In Tongking people suffering from fever are told not to eat of the papaw fruit.

In Kelantan the milky juice of the unripe fruit, mixed with the juice of the immature capsules of the horse-radish tree and the white of a lizard's egg, is used as a poison; when taken internally this is said to be followed by great abdominal pain and the presence of blood in the urine.

The papaw has been alluded to as the mustard tree of the Scriptures.

#### MEDICINAL USES.

A plant so universally distributed and possessed of such varied properties, naturally occupies an important place in native materia medica. Though of relatively recent introduction into India it is, nevertheless, a part of the armamentarium of Ayurveda and Yunani practitioners alike. Medicinal properties are ascribed to practically every part of the tree: the root, the leaf, the seed, the fruit, and the milky juice.

To begin with the root, it is said to be a generative tonic. In Cambodia it is considered diuretic, and it is given internally to arrest the flow of blood in abnormal uterine haemorrhage. In French Guinea it is credited with anthelmintic properties, and as a vermifuge a preparation is recommended consisting of leaves and twigs of purslane 2.8 gram, fresh papaw root 0.75 gram, water 48 oz., the whole boiled down to 32 oz. In the Gold Coast Colony it is said to cure yaws and also piles: the root is ground up and mixed with salt forming a paste which is then treated with water, and the resulting solution is used as an enema; this is supposed to cause abortion in pregnant women, and its use is probably restricted to educated native women of social standing. In Mauritius the dry root has been used successfully in the treatment of kidney trouble.

As regards the leaves, they are used as a worm remedy in French Guinea. A decoction is given as a purgative to horses, and has been recommended for the treatment of bots; but Steyn in South Africa has experimentally disproved its efficacy for this purpose. In the Gold Coast Colony the dry leaves are steeped in

water and the yellowish-red liquor is drunk to cure stomach trouble. In the Philippine Islands a decoction of the leaves is applied as a lotion to wounds and atonic ulcers, or the boiled leaves are crushed and made into a poultice. In the Santal Parganas of India the leaves are reputed to promote the secretion of milk: they should be gently bruised and heated in a pan and applied warm to the breast. In Western India the leaves are used externally for nervous pains; the leaf may be either dipped in hot water or warmed over a fire and applied to the painful part. In Southern India the bruised leaves applied as a poultice are said to have an excellent influence in reducing elephantoid growth. They are also used to extract guinea-worms: an ounce of the leaf is rubbed with sixty grains of opium and sixty grains of common salt, and the paste applied to the affected part—'of course the worm has to be wound out in the usual manner, but it always comes out more quickly and easily when treated in this way'.

To come to the seeds, wherever the papaw tree is found growing its seeds are used as anthelmintic and emmenagogue. In India their juice is made into pessaries to procure abortion. The juice, or a paste obtained by grinding the seeds with glycerin, is used as a cure for ringworm and psoriasis. Mixed with honey the seeds are given to expel roundworms; they are also said to be useful in dyspepsia and in enlargement of liver and spleen. In Cambodia they are prescribed in bites and stings of poisonous insects. In Central and South America they are given as a thirst quencher, and they form a component part of a drink used in fever; they are also used as a carminative.

Furthermore, the ripe fruit is alterative. It acts as a mild laxative and, if regularly eaten every morning, corrects the habitual constipation so common in India. It also acts as a mild cholagogue; hence its use for piles, and for enlarged liver and spleen; to reduce an enlarged spleen the fruit is preferably taken dry and salted. In some parts of India the ripe fruit is said to be useful in chronic diarrhoea, and in some of the Malay islands it is given in dysentery. Syrups, wines, elixirs made from ripe fruit are said to be expectorant, sedative and tonic. The green fruit is a mild laxative and diuretic; when made into a curry it is eaten by women to excite secretion of milk; it possesses ebolic properties and is often resorted to by natives to induce criminal abortion. The mature green fruit, sliced, dried and powdered, is given in doses of from 5 to 20 grains for dyspepsia. In the Philippine Islands, more especially in the province of Bulakan and in Pampanga, a decoction of the green fruit is a popular remedy for indigestion. In the West Indies a slice of the green papaw is rubbed over the pimples which accompany the first stages of the yaws, to abort them; and it is claimed that the ulcers which follow the pimples may also be cleaned in a similar manner. In one instance apparent clinical benefit from eating the fruit was claimed by a diabetic patient; but Bischoff, Long and Sahyum failed to discover any hypoglycaemic action when feeding the fruit to rabbits.

Finally the milky juice or latex has among others a well known medicinal property, for the discovery of which the world is in

the first instance indebted to an old negro woman. Cossigny relates that on her master's farm this woman was entrusted with the humble task of feeding the pigs. Now it happened that she was suffering from worms and had tried many a remedy, but thus far without any success. In course of time she noticed that whenever she fed her charges with slices of green papaw, the animals passed worms. Putting two and two together she started eating sliced green papaw and was relieved of her trouble. On hearing of this unexpected cure the men of science attributed it to the milky juice or latex contained in the green papaw; and a series of experiments afterwards proved that their surmise was correct.

The milky juice of the unripe fruit has ever since been considered anthelmintic and used as such, especially against round-worms. The following mode of administration is still adopted in Mauritius: 'Take of the fresh papaw milk and honey, of each a tablespoonful; mix thoroughly; gradually add three or four tablespoonfuls of boiling water, and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively, if required. The above is a dose for an adult, half the quantity may be given to children between seven and ten years of age, and a third, or a teaspoonful, to children under three years. If it cause griping, as it occasionally does, enemas containing sugar have been found effectual in relieving it.' In Brazil the juice is given in very small doses to avoid intestinal inflammation.

The medicinal uses of the latex are not however limited to the removal of worms. The author of the *Makhzhan* mentions it as a remedy for hæmoptysis, bleeding piles, and ulcers of the urinary passage; it is also useful in dyspepsia; rubbing the milk in, two or three times, cures ringworm or psoriasis causing a copious exudation attended with itching. The juice is often used externally to prevent suppuration. Kilmer writes: 'A malady which the natives call the "cocoa bag" is a troublesome tropical disease, reputed to be hereditary and contagious; at all events it seems to lurk in the blood of persons of otherwise apparently good health and habits. Suddenly the victim becomes a mass of offensive sores, debilitated, etc. The native doctors add the papaw fruit to the diet drinks used in this disease, and succeed in moderating its violence at least. To the sores a paste made with the papaw milk as one of the constituents is also applied.' Again: 'I witnessed a most striking cleansing of a black foot in which the chiga had bored and laid its eggs, producing a mass of foulness beyond description. Here a paste of the papaw milk was pushed into the seething mass and kept for forty-eight hours. It was then flushed, curretted, and antiseptics were applied. A clean wound which readily healed resulted.' The juice will remove pimples and thickened skin as in eczema and corns. It has been used successfully for stomach trouble; it is a reliable stomachic, and is slightly laxative; but it should not be given to pregnant women, as it is emmenagogue. It is applied locally to the *os uteri* to procure abortion. It is also said to be a certain remedy in cases of scorpion

sting, a statement which has been experimentally disproved by Caius and Mhaskar. The milk has been employed in splenic and hepatic enlargements with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily.

The latex is slightly caustic and irritating to the skin, so much so that the collectors get blistered fingers. It has great digesting properties; if dropped on raw meat it dissolves it in a few minutes, and it is, no doubt, to this property that it owes its reputation as a digestive. It has long been used for whooping-cough in Honolulu. It has also been given with good results in diphtheria. A solution of 10 to 30 drops, applied as a paint, rapidly dissolved the false membrane. A number of cases in a hospital for children were cured by this treatment.

The milky juice is extracted by making shallow incisions with a bone or ivory knife, or a wooden splinter, in the rind of the mature but unripe fruit; the juice rapidly exudes from the cuts and is collected in a cup held beneath, then spread on glass to dry in the sun or, if the weather be wet, over a stove or in a hot-air chamber. Drying should be effected without delay but should not be too rapid, a temperature of about 100°F. being the best. The process should be completed in about 24 hours. When the material is crisp-dry, it is reduced to a fine powder, or made into a granular form, and marketed as 'papain'. About 5 to 8 oz. dried papain may be obtained per tree in a year, or an average of about 150 lbs. per acre. The fruits may be tapped at intervals of two or three days, and are not removed from the tree until they cease to yield. Good quality papain may fetch from 7 to 15s. per lb.; but the demand is limited and irregular.

#### PAPAIN.

The term 'papain' is unfortunately applied both to the dried juice of the papaw and to an albuminous digestive ferment obtained from this by precipitation with alcohol. In commerce there are a number of preparations claiming to be the ferment of the papaw, sold as *papain*, *papayotin*, *papoid*, *caroid*, *vegetable pepsin*, etc. On examination several of these substances were found to be merely the dried and powdered latex of the papaw, bearing the same relation to the true separated ferment as the dried mucous membrane of the stomach might bear to purified pepsin. As confusion reigns supreme in the literature referring to this subject, and as, except for a possible question of degree, the properties and uses of the latex and the ferment are the same, no attempt has been made here to treat the two separately.

As it occurs in commerce, papain is a greyish, fine powder, which in appearance, odour, and taste strongly suggests pepsin. Its natural colour is light brown; but bleaching is commonly practised by manufacturers. In fact much sophistication obtains in the preparation of papain. The French product is usually mixed with starch which is added as a preservative. As starch, however, is not naturally present in the fruit, it rightly figures in the list of adulterants which also includes bread, arrowroot, the milk of

the wild cactus, the milk of gutta percha, boiled rice, etc. Adulteration with boiled rice, to the extent of 10 per cent, is a clever Indian adulteration difficult to detect.

Papain, which acts as a digestant in acid, alkaline, and neutral media, is used to prepare foods for assimilation, and figures largely and prominently in foods for invalids and children, in chewing gums, etc. It is extensively used as a digestive in France and Germany, and has been given with good results to children. Nevertheless, the digestive power of the papaw falls greatly short of the claims made for it. It is commonly asserted that, when the stomach is acid, it is much superior to pancreatin, because its action is not markedly affected by contact with the acid; but in experiments made by Wood with a papoid from one of the most renowned manufacturers no digestion occurred, and it is probable that most of the article of commerce is inert. As a matter of fact many practitioners prefer to papain the milky juice fresh from the tree, which is not only more efficacious as a digestive, but is in addition a good taeniocide. It has been, moreover, shown that the bleaching of papain is a great mistake and that in a representative preparation the ferment action is most marked when all the proteins are associated together in the natural form.

'Acid glycerole of papain' is largely used in dyspepsia as it dissolves mucus in the stomach, which prevents the absorption of food in cases of indigestion, colic, flatulence, gastric ulcers; and it is also greatly recommended as an aid to the nutrition of patients suffering from phthisis. The liquid preparations are said to be suitable to reduce enlarged tonsils and adenoids, but unless there is some contra-indication to thorough surgical procedure, the practice is not particularly good. For this purpose a solution of 1 to 2 of papain in 10 each of glycerin and water is swabbed over the parts. A solution of this strength is used as an application to fissures and ulcers of the tongue; though lozenges are usually preferred for syphilitic ulcers of the tongue and throat. A stronger solution, 1 part of papain in 2 parts each of glycerin and water, is sprayed into the throat to dissolve false membrane, and is applied in compresses to warts to effect their dispersion and to malignant ulcers to cleanse them. It has even been used as a local application in epithelioma; but papain as a curative agent in cancerous affections has been unanimously found wanting. A 5 per cent solution with  $2\frac{1}{2}$  per cent of sodium carbonate is used as drops into the ear in chronic otorrhoea. For thread-worms papain, 5 or 10 grains in a half pint of water, may be thrown into the colon as high as possible. A pigment well rubbed is used to remove corns, warts, or any hardness of the skin, and in chronic eczema.

The proteolytic power of papain is exerted on living as well as on dead proteins, and injections into the tissues bring about topical destruction. Intravenously administered it destroys the blood cells and acts as a powerful poison. Injections into tumours have been made in the vain hope of destroying their vitality, but it has been used with more or less success for the removal of false membrane from the pharynx. Hypodermic injections in cases of elephantoid



growth usually results in fever and intense local irritation pointing to the unadvisability of adopting such a mode of treatment.

For internal use papain may be encapsulated or dissolved or emulsified with glycerin and aromatics, a solution of this kind making an admirable vehicle for salicylates, mercurials, iodides, iron salts, and other medicaments that might irritate the stomach. It may likewise be associated with diastase or pancreatin and given about two hours after meals, or sooner if distress be felt. Like all the digestive ferments, it must be withdrawn after a short course, except in cases in which there exists some organic lesion from which recovery cannot be expected, and artificial digestion has become a constant necessity. It has no antiseptic power and even strong solutions will putrefy.

#### PA-PAY-ANS.

In the words of Kilmer, 'the papaw has been brought to America as a cure for the national disease, dyspepsia'. Indigestion, to call it by its name, is one of the most unpleasant joy-killers to which the normally healthy man is subject. Unless it becomes too obnoxious, it is usually endured as an annoyance, and treated as a natural consequence of the daily routine. The sufferer means to reform his habits some day. His intentions are determined while an attack is on; but when the discomfort passes and temptation again beckons, forgetting all his good resolutions he fills himself with what Shakespeare calls 'the perilous stuff that weighs about the heart'. Hence the shelves of the chemists are replete with brands of pills, lozenges, tablets, powders, wines, and elixirs without end for 'removing flatulence, vertigo, weakness, and other symptoms of indigestion quickly and pleasantly' . . . and for 'promoting appetite, digestion, and the elimination of toxic and waste material'.

One such a drug is 'Pa-pay-ans (Bell)', the selling point of which was the supposed presence of papain. This ferment, Bell and Company alleged, was present in their tablets and they claimed it to be 'the digestive principle obtained by our own exclusive process from the fruit of *Carica papaya*'. As long ago as 1909, the Council on Pharmacy and Chemistry endeavoured to detect the presence of papain and to determine the digestive power of the tablets, but with negative results. The efforts of other chemists proved equally futile. Pa-pay-ans was essentially: charcoal, baking soda, ginger, and oil of wintergreen. And, consequently, the drug possessed the virtues—and they are few—and the limitations—and these are many—inherent to a mixture of baking soda, ginger, and charcoal.

In January 1914, Bell and Company changed the name of the product 'Pa-pay-ans (Bell)' to 'Bell-ans'. As the *Journal of the American Medical Association* remarked soon after, it seemed probable that, as the name of a nostrum of this kind is the manufacturer's most valuable asset, the name was hardly changed, as was alleged, for purely euphonious reasons. It seemed more likely that as analyses had indicated there was not, and probably never had been, any appreciable amount of papain in the product, the

change of name might be due to the fear that some day the misleading name might bring the preparation in conflict with the Federal Food and Drugs Act.

#### CHEMICAL COMPOSITION.

Upon standing for a few minutes the juice separates into two parts, an aqueous liquid and a white somewhat coagulated pulpy mass. In the aqueous portion is an albuminous substance possessed of enzymic properties, papain. According to the researches of Martin—and others—papaw juice contains besides papain, a water-soluble lipase, a lab or milk-curdling ferment, globulin, albumin, and two phytalbumoses. No peptones occur in the juice, but leucin and tyrosin are present.

The seeds contain a glucoside, caricin, which resembles sinigrin. They also contain the ferment myrosin, and by the reaction of the two a volatile pungent body is produced, smelling like oil of mustard.

The leaves have been reported to contain a glucoside, carposide.

The fruit contains vitamin C in abundance, with less of vitamin A, and still less of B.

An alkaloid, carpane, was obtained by Greshoff from the fruit and seeds, but especially from the leaves, of the papaw tree, and was afterwards studied by Merck, van Rijn, and Barger. According to Plugge, the alkaloid depresses the action of the heart and adversely affects respiration; whilst von Oefele recommends its application by subcutaneous injections as a substitute for digitalis in cardiac diseases. Chopra records that 'from the data already in hand, it is evident that it is not very toxic. A dose of 5 mgm., when injected intravenously in experimental animals, causes only a slight fall of blood pressure which, however, returns to the normal level within a very short time. The action of the heart is depressed and both the ventricles and auricles show evidence of slight depression. The respiration is not depressed to any great extent. The volumes of the different organs are very slightly affected, if at all. The alkaloid has not been used in therapeutics.'

Merck list carpaine hydrochloride as a cardiac tonic, and diuretic; for use in mitral insufficiency and aortic stenosis.

#### COMMERCIAL POSSIBILITIES.

By way of conclusion a few words may be said about the commercial and tradal prospects of either the papaw or papain. As far as the fruit is concerned its marketability depends evidently on three factors: transportation, demand, and supply.

The transportation question should not offer any difficulty as long as sufficiently large quantities can be procured for exportation from the plantation to the consumers. The art of transporting all kinds of fruit has reached such a degree of perfection, that there is no reason why the papaw should prove an exception to the rule as far as its preservation on board ship is concerned. In fact, successful experiments have already been made in this line between Honolulu and San Francisco.

A far more doubtful factor is the creation of a market for the papaw from a consumer's point of view. The papaw is in no way superior, and perhaps not even equal, to the home-grown fruits of those continents where it would have to be marketed. In America, Australia, and Europe apples, pears, peaches, plums, cherries, apricots, and so on are more tasty than the papaw; and this would really be a case in which a liking for the fruit would have to be gradually developed among would-be consumers. Such an experiment is likely to prove expensive; its success may be slow in coming, if it comes off at all.

Besides this, suppose a demand for the papaw should eventually materialise, there is no guarantee that the grower could be able to provide the needed supply. This brings us to consider the question whether by any means the growers can increase their harvest of papaws according to the need of the market. From what has been said when describing the fruit-bearing capacities of the tree it follows that the grower is for ever facing the unknown. It seems to be all a question of luck whether the growing plant will prove useless or fruit bearing; and, as long as these circumstances prevail, the very idea of creating a market for the papaw is somewhat in the nature of a wild goose chase.

Finally as regards the commercial prospects of papain; the latter article being a medicinal drug with well defined therapeutic properties, it stands to reason that the market for papain will mainly be determined by the needs of manufacturers of pharmaceutical products. As was already pointed out, the demand for papain has, in fact, been both limited and irregular; and there is no likelihood of its ever becoming a widespread constantly used commercial commodity.

The United States of America, the largest consumer, import annually to the value of from £15,000 to £16,000. Ceylon is one of the principal exporters: from 1911 to 1913 the exports amounted to 6,111; 12,920, and 18,548 lbs. representing a value of 34,221; 50,668, and 71,849 rupees—numbers which in respect to quantity and value bear no comparison with other commercial commodities.

There is, therefore, very little hope of a prospective boom either in papaws or in papain.

#### VERNACULAR NAMES.

*Adang*: Adiba—; *Annam*: Du du, Phan qua thu, Trai du du—; *Arabic*: Aanabahe-hindi, Amba hindi—; *Ashanti*: Bororfere, Brorfenini, Brosownini—; *Awuna*: Adiba, Aduba, Yevudiba—; *Bengal*: Papeya, Pappaiya, Pepiya—; *Betsimisarakā*: Papay, Voapaza—; *Bombay*: Papai—; *Brazil*: Mamamoeiro, Mamao, Mameo, Mamerio, Mamoeiro, Papai—; *Burma*: Pimbosi, Simbosi, Thimbaw, Timbosi—; *Cambodia*: Lohong si phle, To hong phle—; *Canarese*: Goppe, Pang, Pappayi, Parangi—; *Carib*: Ababai—; *Cochin-China*: Du du, Kay du du—; *Cutch*: Papaya—; *Deccan*: Popai—; *Egypt*: Babas—; *English*: Melon Tree, Papaw, Papaya, Papeta, Pawpaw, Tree-melon—; *Ewe*: Adiba—; *Fanti*: Borosow, Borosownyin—; *French*: Figuier des îles, Figuier des nègres, Melon

des tropiques, Papayer, Papou—; *Fulah*: Budibaga—; *Ga*: Akpakpa—; *Gujerat*: Chibda, Erandakakdi, Jhadchibhadi, Kath, Papayi, Papi—; *Hausa*: Gwanda, Gwanda masar—; *Hindi*: Andakharbuja, Papaya, Pepiya, Popaiya, Urunkhurbooza—; *Konkan*: Popai—; *Krobo*: Gor—; *Kwang Tung*: Mou Koua—; *Laos*: Mak hung—; *Madagascar*: Mapaza, Paza—; *Malaya*: Papaya, Pohunbetek—; *Malayalam*: Kappalam, Karmmosu, Pappayam—; *Marathi*: Papaya—; *Maya*: Put—; *Mexico*: Chakarteca, Jacarata, Lechoso, Melon zapote, Papaya, Papaya los pajaros, Papayo—; *Mundari*: Ambridaru, Amritdaru, Dindapabita, Jomejaradaru, Pabitadaru—; *Paraguay*: Mamon—; *Persian*: Aanabahe-hindi, Ambahindi—; *Philippines*: Capayo, Kapayo, Papaya—; *Portuguese*: Papaia—; *Punjab*: Arandkharbuza, Kharbuza—; *Samoa*: Esi, Esi fafine, Esitane—; *Sanskrit*: Chirbhita, Erandachirbhita, Malikadala—; *Sinhalese*: Copal, Cucaracho—; *Sind*: Chilbhado, Katha, Katha chibhadu, Paputa—; *Sinhalese*: Papaw, Pepol—; *Spanish*: Papaya—; *Tagalog*: Capayas—; *Tamil*: Pappali, Papayi, Parangiyamanakku, Pasalai—; *Telugu*: Boppayi, Madanana, Madhurnakamu—; *Tongking*: Du du—; *Tulu*: Bappan-gayi—; *Twi*: Brorfre—; *Urdu*: Erand-kharbujah—; *Uriya*: Omrytobhonda, Popoya—; *Visayan*: Capayas—; *Yemen*: Amba hindi—; *Yucatan*: Chieh put, Put—.